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The Air Line Pilot

October, 1955

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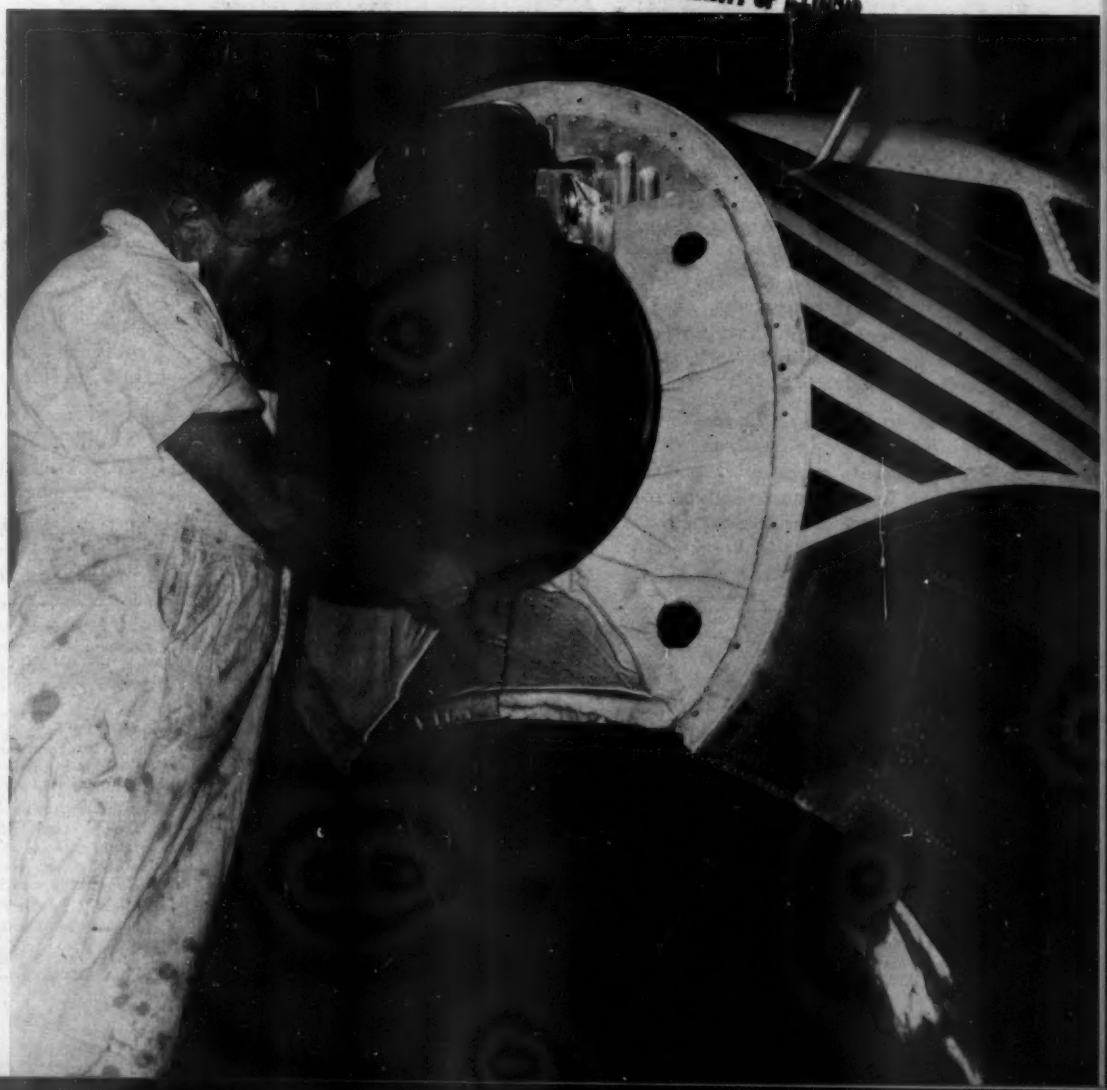

PAA Installs Radar
—Page 13—

An Antidote For "Collision-itis"?

Look Out The Window, By All Means. But It Gives Only 5% Protection If You Give 100% Of Your Time. Here Are Some Straight-From-The-Cockpit Notes

By H. F. Hill, Jr.
Senior Copilot Representative, UAL

We almost tangled airscoop holes with a DC-7 over New York City the other day. He drove by head-on, right at our altitude, 150 feet off our wing tip, *on instruments!* We were making our ILS approach in the base of a thunderstorm, when we saw him flash by for about 1/10 of a second. A check with the tower revealed that he had departed VFR two minutes before we saw him. The weather reported at the field was perfectly "legal" for a VFR departure, but, as most of us have at one time or another, he got caught, fresh out of VFR sky. So there he was —climbing his transcontinental nonstop DC-7 up the ILS on instruments as we were weaving our way down on the gauges. Can you imagine what the public's reaction would have been if the burning wreckage and dead bodies from these two four-engine major air carrier airplanes had fallen into the city? "Move dem airports to da country!" This is the current suggestion of one "Airport Commission."

Right now you are probably recalling that "near-miss", *you* have had recently. Almost every pilot you talk to has had one lately.

Looking Out The Window

All the literature in our mail seems to stress the great importance of looking out the window, and that controversial CAA poster seems to assume that everybody in the world looks out airplane windows, but pilots. I would be the last to deny that, under today's traffic conditions, vigilance is important, but—is this the sole answer to the mid-air collision problem? Is looking out the window protection enough?

The aircraft manufacturer built into the cockpit about the same proportion of visibility in all directions, as The Good Lord gave us when He located our eyeballs where He did. It is a simple fact that, from the cockpit, you cannot see directly above, directly below, nor directly behind your million dollar airplane any more, than your eyeballs can see the top, base, or back of your head. (In the case of most heads, this is probably fortunate.)

Well, just how much *can* you see?

5% Visibility

Sit in your cockpit some day and mentally describe a 360 degree azimuth through each of the airplane's three dimensions: longitudinal, vertical, and horizontal. Now take your protractor and measure off through each dimensional azimuth the number of degrees that you can see from your normal slumped sitting position. Divide this total number of degrees, that you *can* see by the total number of degrees there *are* to see and you will discover that *your visibility factor in today's air carrier aircraft cockpits is about 5%.* (If you spend the whole trip looking out the window, that is.)

When you say, "Affirmative, we can climb VFR" (or, descend, or, maintain 1000 feet on top VFR), your are accepting the responsibilty to remain clear of all other aircraft in your vicinity. Yet, at any one instant you can only see 5% of the sky through which you go "barrelling along" at 300 mph up to your armpits in gauges, levers, switches, and rule books.

Because cockpit visibility is constructed into the airplane as a constant factor, the technique of making turns during climbs and descents merely allows you to scan that 5% visibility around different sections of the sky. While this increases your protection immediately above and below your airplane somewhat, it simultaneously decreases your protection directly forward where you need it the most. Banking and turning, particularly at night, actually tend to delay the time, it takes for you to analyze the flight path of that airplane that you luckily happen to pick up on your rotating 5% vision scope.

How much chance is there for the pilot's eye to see soon enough to avert a collision with that airplane that does happen to fall in his visibility zone?

From The Side Quarter

Consider first the airplane closing from a side quarter. It is generally agreed among pilots that the airplane you can see move across your line of sight is *not* on a collision course. It is that seemingly motionless speck ap-

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Ed Modes, Editor

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pearing, like a bug corpse on the glass, that *is* a "collision waiting to happen." Some of those "specks" get hazardously close before they become large enough to trigger the attention of even the most alert pilot's eye. The airplane closing in on us from a side quarter can be avoided through alertness, but it is *physically impossible* to see that airplane closing from behind, above, or below! Example: The Michigan City incident.

Head-On

What about the airplane closing with you head-on? The speed of a U.S. Colt Automatic 45 caliber bullet is 552.3 mph. The cockpit-to-cockpit closure rate of two DC-6's at cruise airspeed is 600 mph.!

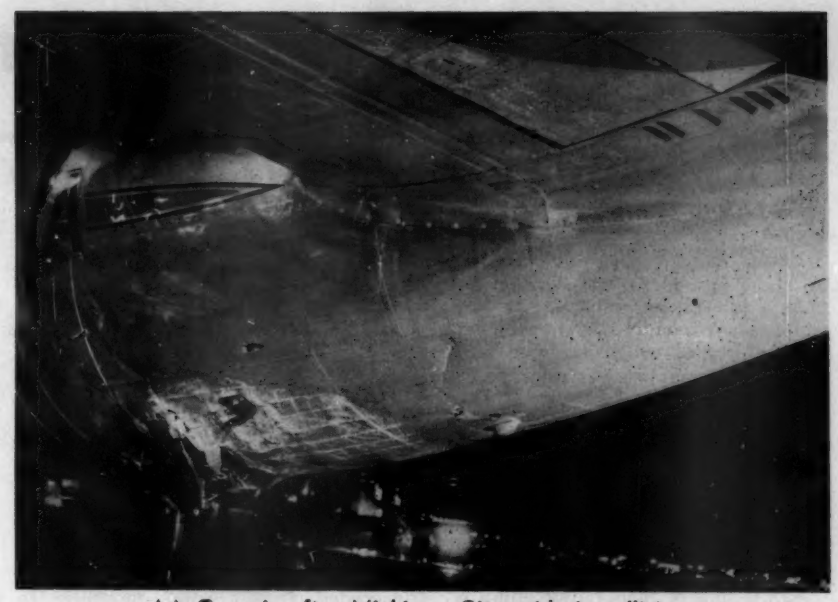
The USAF Medical Safety Division conducted tests recently and reported the following pilot and aircraft reaction times:

0.1 second—eye image to brain
1.0 second—recognition time of brain
5.0 seconds—time to make decision
0.4 second—decision time to muscle
0.4 second—time for muscle to react
5.0 seconds—air reaction lag

11.9 second—total time for pilot to see object and move aircraft.

At a 600 mph closure rate, it takes 18 seconds to close 3 miles, 12 seconds to close 2 miles, and 6 seconds to close 1 mile. If you subtract the 11.9 seconds for pilot and aircraft reaction lag, it follows then that two DC-6's approaching head-on with the "VFR" visibility of 3 miles have a non-collision safety factor of 6.1 seconds. At 2 miles the margin is shaved to 1/10 of a second, and at 1 mile you won't even have time to complete your decision.

The next time you are flying through "unlimited" visibility conditions, calculate the total number of seconds from the instant you can indentify that speck on the glass as a head-on airplane until it passes you. Due to the convergence factor of the eye and the blending of the aircraft silhouette into the sky, even with so-called unlimited visibility during daylight, head-on airplanes are invisible to the naked eye until they are within 15 to 20 miles range. At today's closure rates and under the *very best possible* visibility conditions, the pilot has a *maximum* head-on non-collision safety factor of 1 minute, 50 seconds! Because of the greater contrast at night and due to recent lighting developments, some aircraft lights are visible as far as 30 to 40 miles at night, giving the pilot a tolerable maximum non-collision safety factor of as much as 4 minutes on a clear unlimited night. Even so, sometimes you can't be sure if that flashing red light you see is an airplane in the sky or a Grimes light advertising a Kiddyland.



AA Convair after Michigan City mid-air collision.

Visibility Reports

What about the U. S. Weather Bureau terminal visibility reports? First of all, they apply only to the immediate area around the airport that the observer can see. How many times have you encountered ½ to 1 mile visibility in smoke and haze over the city as you approach airports officially advertising 8 to 10 miles?

Secondly, the regulations state that the official visibility to be reported, shall be determined by calculating the farthest distance that a known object can be clearly distinguished and identfied by the observer on the airport. These "known objects" are invariably much larger than airplane silhouettes and can usually be located through their relative bearing to the airport and other more clearly visible and closer landmarks, much in the same manner as the pilot makes a "contact" approach to a familiar airport.

If you have been of the opinion that the officially reported terminal visibility is the actual distance at which you can see another airplane approaching head-on, try this experiment: The next VFR day, you approach head-on a tower equipped with radar, give the operator your altitude and exact position and ask him to give you the radar calculated distance at which he first sights you. You will discover that the "slant range visibility" at which *you* will first see the tower, is well below the terminal visibility being advertised and you will be amazed, that even though he knows your direction of approach and is looking for you, at how close you can get to the tower before he sights you. It isn't because they are lazy that tower operators are asking you for your position on your VFR approaches. *They can't see you!*

In Metropolitan Areas

Finally, how many days do we have much above 4 to 5 miles visibility reported in the congested metropolitan areas? (They are still four "i's" in "visibility" but darn little visibility left for our two eyes.)

Bearing today's closure rates in mind and in view of the diminishing visibilities that have crept in on us, it is interesting to note that CAR 40.405 (a) and (b) allows air carrier pilots to take off and land *VFR* with 1000 feet ceiling and *one mile* visibility in the daylight and *two miles* visibility at night. What's more, if the restriction to visibility is "strictly local," and, if you can make all turns after take-off, prior to landing, and all flight beyond one mile out of the local restriction, then *you can take off and land VFR with ½ mile visibility!* How many times have you sat patiently at the end of the runway waiting for your turn to depart IFR and then done a "slow burn" while another pilot sneaks out "VFR" under the above regulation? In a hurry to save a few minutes, he will probably arrive at his own mid-air

(Continued on Page 14)

The Booming Aviation Economy

Pilots Are A Part Of The Nation's Fastest Growing Industry And One That Is Proving Itself To Be The Country's Best Investment

By Helmut Lorsch
Asst. Editor, THE AIR LINE PILOT

As a pilot, have you ever sat down and seriously pondered the vastness of the industry of which you're a part? Probably few pilots have, other than in a general way.

Yet since 1938, and even more emphatically since 1945, aviation has been one of the nation's fastest growing industries. Certainly, its potential for the future is among the greatest. Moreover, day in and day out, it is proving the U.S.'s best investment.

At the hub of the aviation industry, of course, is commercial air transport. Clues to the size of air transport, in relation to non-aviation industries, are found in many fiscal reports, trade analyses and surveys, and government figures pointing up facts like these:

▶ In the past year, one air line was the tops in revenue among all transportation companies, and several others in the top ten.

▶ Six U. S. air lines were among the top 100 national newspaper advertisers in 1955, according to the advertising bureau of the American Newspaper Publishers Association.

Dynamic Growth

Compared to 1938, the Air Transport Association says, a small industry has developed into a dynamic giant. It offers these figures for all certificated air lines for comparison:

The number of cities served by air transportation has increased from 286 in 1938 to 695 in 1954, a percentage increase of 143%. The number of airplanes in service have increased 321% from 345 to 1,454. Seats available daily have risen from a meager 4,800 in 1938 to 74,400 in 1954, up 1,440% In 1938, there were 284 daily schedules, but today there are more than 6 times that many, 2,208. Number of passengers carried has increased over 2,000%, the 1954 figure being 35,184,000 as compared to 1938's 1,536,000. Today's 118,000 people employed by the air lines are 787% more than the 13,300 employed in 1938. Total air line payrolls of $27,396,000 in 1938 vs. $526,182,000 in 1954, represent a 1,821% increase.

Although these figures only go to 1954, 1955 promises to continue the trend.

One Air Line's Report

For example, one air line reports: "In November, 1954, our scheduled flying hours were slightly over 41,000. Our lowest month of this year was February, when we flew more than 41,500 hours. In March and April, we exceeded 46,000 hours monthly. In May, we flew approximately 49,500 hours. In June, we flew more than 50,500. July and August call for still more increases."

The same company also reported: "We have recalled all of the remaining flight crew members on our recall list numbering 130 pilots and 25 flight engineers. In addition to those recalled, we have hired 137 new co-pilots and 62 new flight engineers and trained or requalified 229 new and recalled co-pilots."

Benefits To All

This growth and expansion has had a profound impact and meant many things to the American people, the U. S. government, and the national economy. In general, it has:

▶ Provided Americans and the air traveling public the most efficient, most useful, and most competitive air line system in the world.

▶ Proved itself to be Uncle Sam's best buy both as national defense and peacetime commerce asset.

▶ Taken its place in the national economy as a fundamental foundation of our prosperity.

If only as a transportation medium, air transport has become a necessity to our way of life.

But beyond this, it is bringing returns to the government and citizens of this country in many ways.

Air Mail Experiment

Take the postal service, for instance. Both traditional air mail and the new first-class-mail-by-air experiment launched in 1953, enables the government to provide the world's finest postal service to its citizens and still generate what is actually a profit.

In 1954, 1,397,547,000 airmail letters (28,715,000 ton miles) were flown. The government received 7.01 cents per letter, or $97,919,000, while it paid the air lines 1.18 per letter, or $16,502,000. This left a balance of $81,417,000 in favor of the government. Although air mail gets first call on air line space, it actually travels cheaper than people. The average rate paid by the government for the carriage of domestic air mail in 1954 was 48.6 cents per ton mile. The average passenger fare, on a ton-mile basis, was 53.5 cents.

The first-class-mail-by-air experiment tells pretty much the same story. It is now being conducted between 119 cities. In the first year of the experiment, senders of letters saved nearly ten billion hours of delivery time and hundreds of millions of letters reached destination an average of 11½ hours sooner, than if they had moved by surface means. The air lines got .003 cents from each 3 cent stamp covering a letter, which traveled by air under the experiment — the Post Office got 2.97 cents.

No 'Subsidization'

The air line industry is often accused of being heavily subsidized. Actually, the term "subsidization" is a misnomer. Public service revenues is a more accurate term. Nor do they cost the government in the long run.

Here are the figures for 1954:

It cost $1,325,000,000 to operate the U. S. air line system. Of that sum, the government put up $73,000,000, the air lines $1,252,000,000. On the other side of the ledger, the certified scheduled air lines paid the government $57,500,000 in federal income tax, $2,000,000 miscellaneous excise taxes, $120,000,000 in transportation excise tax, while at the same time, creating $171,700,000 postage revenues for the

Post Office Department. In addition, the air lines paid federal gas and oil taxes of $16,000,000 for their share of the use of the federal airways system, although it is calculated that only $12,500,000 would have covered their share for the maintenance and operation of this system.

Thus for every dollar of the $73,000,000 put up by the government to ensure air service, where it is needed, the air lines developed $4.80 in return for the government.

An item, which cannot be reduced to a dollar-and-cents evaluation, is the record of commercial air transport to the national defense.

War Service

In the years 1941 to 1953, the air lines "went to war" twice, and they stand prepared to go again wherever and whenever called. Today, they provide this country with the biggest civil air reserve fleet in the world. They operated the first air line mission in support of urgent military requirements within seven days after the bombing of Pearl Harbor. In 1950, they flew an air line mission across the Pacific within 24 hours after the North Korean Reds crossed the 38th Parallel. They helped supply the Berlin airlift.

During World War II, the air lines of the United States:

- Sent one-half of their fleet to war around the world with the Military Air Transport Services.
- Used their "know-how" to train many thousands of men and women for the military air transport effort.
- Used their maintenance bases to modify military aircraft to fit a wide range of missions under a great variety of climates.
- Used their manpower and resources to conduct research on behalf of the Government.
- With less than one-half of their fleet, operated around the clock to provide essential wartime travel to the tune of 10 billion passenger-miles—plus large quantities of mail and express.

Ready Reserves

Today, in a "cold war" atmosphere, as a result of planning by the Joint Chiefs of Staff, the air lines have created a Civil Reserve Air Fleet consisting of about half of their modern 4-engine fleet, fast transport aircraft capable of over-ocean flight. These 290 airplanes are subject to call, with their crews, within 48 hours. Presenting an investment of about $400 million in number of units, it is approximately equal to the fleet now operated by the Military Air Transport Service. In its combined airlift, it is nearly ten times greater than the capacity of the civil air fleet, which performed with such distinction in World War II.

The American air line industry has provided the basis for new business enterprises and payrolls. It has developed new markets and widened old ones. Some examples:

In 1938, the domestic scheduled air lines served 183 cities in the United States, which, with their trading areas, represented half of the population of this country. Service was far less frequent and air lines were not so large or so fast as they are today.

Today, some 543 U. S. cities and their trading areas have direct, easy access to air service, which represents nearly three-quarters of the population of the United States. Total value of retail sales in those cities was $100 billion, based upon 1948 statistics (the latest available), which was about 75 per cent of the total U. S. retail sales.

Airlines' Record

The Civil Aeronautics Act of 1938 requires the air lines to serve the commerce of the United States; the Postal Service of the United States and the national defense. That it is accomplishing these objectives, is amply demonstrated by their record, which includes:

- Carrying more than 65% of the free world's air commerce;
- Providing the world's biggest Civil Reserve Air Fleet;
- Offering more mail service by air than any other nation in the world.

Recent significant developments in the aviation industry, including the launching of Capital Airlines' Viscounts, American Airlines' order for 35 Lockheed Electras, the development of the Boeing 707 and the announcement of the DC-8, among others, are signalling a promising future in air transportation.

Every pilot can indeed be proud of the part he has played in the progress of America's most dynamic industry, in which he has cast his professional career.

Deputy CAA Administrator

Charles J. Lowen

Appointment of Charles J. Lowen as Deputy Administrator of Civil Aeronautics, U. S. Department of Commerce, was announced recently by the Administrator, Frederick B. Lee.

Lowen is a pilot with a background of 17 years in aviation. Born in Denver in 1915, he went into the aviation sales and service business there in 1938 after studying at the University of Colorado.

He left this activity in 1942 to enter the Air Transport Command as a second lieutenant. In 1945, after duty in all theaters that included ferrying four-engine aircraft and commanding Johnson Island in the Pacific, he retired with the rank of major.

For the next three years he was with Capital Airlines as Assistant Director of Operations (Domestic) and Director of Overseas Operations. From 1948 to 1951, he was Director of Aviation for the city and county of Denver, leaving this post to devote full time to his automobile distributorship.

He gave up this distributorship in 1954, when the company he was representing merged, and became Manager of Safety and Excise for the city of Denver, a post he held until coming to Washington.

What's Ahead In Turbo Power

Text Of A Paper Delivered At The Institute Of Aeronautical Sciences' National Turbine Powered Air Transportation Meet

By Charles W. Carmody
Airways Operations Division, CAA

At the outset, I should like to state two points concerning this discussion:

▶ First, this article will concern itself solely with those turbine-powered transport aircraft now being planned and built for future civil use, and does not include military tactical-type aircraft, nor those civil turbine-powered transport aircraft already in service.

▶ Second, in discussing the various engineering aspects of aircraft and engines, I shall attempt to report what a majority of industry engineering opinion believes will be, or has been proven to be, practical.

A number of these developments will require determination of airworthiness, and some new operating practices described have not yet been approved for air carrier use. I have limited myself to discussion of the points herein from the air traffic control operations standpoint.

Loading And Ground Operation

In each facet of operation, considerable planning has been expended to enable the turbine-powered transport to compete without privilege or special consideration. From the first phase of a typical flight, concrete results of this careful planning are evident. It is likely that the turbine-powered transport, including the jet, can be loaded at the same gate positions as the Constellation, DC-6 or -7 and Stratocruiser, and be taxied, not towed, into and out of loading position.

We have been told that initial studies show the blast and heat effects to have been somewhat overemphasized. The turbojet and turboprop may be taxied on only two engines—but even with four-wing or pod-mounted jets, the blast effect at 100 feet with power required for taxiing would not be any greater than the DC-6, and the free air temperature in the same area would be increased about ten degrees Fahrenheit. There has been some exploration of various means of reducing these effects even further by such devices as shortening the normal length of the nose gear strut to give the blast an upward angle while standing or at taxiing speeds.

There has been considerable speculation and much advance pessimism regarding ground delays and the terrific cost in fuel consumption with both turboprop and turbojet aircraft. Initial studies indicate that the suggested practice of permitting turbine-powered transports to absorb most of their take-off delays at the loading gate is fraught with other problems.

▶ First, most major airports today are fighting the battle of inadequate ramp space and shortage of loading gates. Even those few fortunate cities with new terminal buildings and adequate loading areas have calculated their future expansion capability on a predetermined ratio of not more than 20 to 30 minutes gate occupancy time per aircraft, which barely allows for passenger and cargo handling and refueling time.

▶ Second, few, in fact very few, airports have taxiways and warm-up pads adequate in size to permit an aircraft to taxi from the ramp area to take-off position, *past* those aircraft awaiting take-off, even on a clear day, during peak traffic hours. At an airport such as Washington, for example, the only way that an aircraft in third or fourth position awaiting take-off can be cleared off first, is by having those ahead of it taxi onto the runway, down the runway to the first turn-off, then back into position again.

▶ The third hitch in such a procedure is that a rather extensive and convincing public relations job would be required to inform pilots of other aircraft, passengers in turbine-powered aircraft, and even passengers in other aircraft, why some aircraft must take extensive delays in take-off position while another taxies by to take-off

IAS' Turbine-Powered Air Transport Meet

What's ahead in airline transportation, the problems to be faced and their possible solutions, were discussed at the Institute of Aeronautical Sciences' National Turbine-Powered Air Transportation Meeting, held in Seattle, August 8 - 10. The Institute is an organization of aeronautical engineers, including airline operations experts and others interested in airline operations.

(ALPA members are encouraged to become members of the Institute. Any pilot, who desires to become a member, should write to the Home Office for application blanks. ALPA's engineers, T. G. Linnert and C. F. Eck, may be used as references.)

The obvious attraction of the Seattle meeting was the ever increasing interest of both the airline operators and the aircraft manufacturers, in agreeing on orders for modern turbo-jet and turbo-prop transports. What was on the mind of those attending, was expressed by Peter G. Masefield, British European Airways executive, when he declared that the jet powered aircraft, needed by the world's airlines within the next few years, will total an investment of about $7 billion, including necessary spares. Among the types, he envisioned as necessary, are long-range jet, long-range turbo-prop, medium-range jet, medium-range turbo-prop, short-range jet and short-range turbo-prop.

The meeting was also addressed by representatives of U.S. aircraft manufacturers, who stressed the advantages of their particular turbo-jet or turbo-prop planes about to go into production. A report on the operational data of the Viscount, now in line service on this continent, was given by J. T. Dyment, TCA's Director of Engineering.

Other foreign representatives discussed the French jet SE 210 Caravelle and the Fokker F-27, twin-engine turbo-prop craft.

Air traffic problems, to be faced in the operation of jets, were outlined by airline representatives and C. W. Carmody of the CAA.

without delay. The British, with lower traffic densities and a smaller problem of various companies competing over the same route segment, have been working for some time on the same public relations problem.

It appears possible, on the other hand, to build a turbine-powered aircraft with integral starting built into at least one engine and the capability of starting others with energy derived from it, such as by air bleed-off one of the compressor stages. Entirely within the realm of practicability, it seems, would be the practice of starting only two engines at the ramp, taxiing on two engines, stopping one of these during a long delay, then starting the remaining engines only shortly before take-off. The only readily apparent alternative is adoption by all aircraft operators of the procedure of taking extensive delays at a ramp. The various aircraft operators have not looked with favor on such a procedure in the past, due both to loading gate scarcity and our inability to forecast probable take-off clearance times with satisfactory accuracy.

Take-Off And Climb

We find no necessity for special handling or procedures once the turbine-powered aircraft is approaching take-off position. The pre-take-off check list requires no time-consuming engine runup and check, and these aircraft appear capable of taxiing immediately onto the runway, with only momentary hesitation, if any, before beginning take-off roll. Runway length requirements appear to be consistent with current transport aircraft of the same range and, although gross weights will approximate twice that of today's large transports, the load will be distributed over twice the number of tires.

Climb to cruising altitude also presents no insurmountable problems. Climb rates below the optimum will cost a greater fuel consumption rate, but are easily possible, and temporary leveling off at altitudes below cruising altitude, when required by air traffic control, will be far simpler than with piston-driven engines with throttle, propeller pitch, mixture, cowl flaps and other controls, although any delay in reaching cruising altitude will result in higher fuel consumption.

Cruise Operation

The subject of optimum cruising altitudes, and the need for "climb cruise" procedures is the next potential problem area. The turbine engine is sensitive, insofar as fuel consumption is concerned, to altitude and temperature. In a typical jet transport, for example, the *optimum cruising altitude pattern* for a 3,000-mile flight would be, approximately, establishing cruise power on reaching 32,000 to 33,000 feet, then a gradual drift upwards reaching 44,000 to 45,000 over the point at which descent would be started. The impact of such a flight procedure on airspace capacity under instrument flight rule conditions would create an insurmountable problem.

In our discussions with aircraft company design engineers, the "cost" of level flight, and "step-climb" procedures were explored. We find that, in the above example, conduct of the 3,000-mile flight in two sections of level flight, with a one-step altitude change about half way, results in approximately a 30-mile loss of range—between one and one and a half per cent. Two steps of altitude change, with three sections of level flight, result in less than one per cent difference in fuel consumption.

In later discussions with air carrier representatives, they indicated that the "optimum altitude" would be entirely disregarded in their operational plans, except for long transoceanic nonstop operations, and that even these long-range flights would be conducted in constant altitude segments, with a one- or two-step altitude change requested en route. They pointed out that turbine-powered aircraft would be purchased primarily because of their higher speed and that optimum cruise altitude and power do not mean optimum speed—in a turbojet, a cruising altitude of 10,000 feet below the average "optimum altitude" will increase the speed more than 11 per cent, but at a higher fuel consumption rate. It was indicated that in "normal" airline operation, it is planned to utilize maximum speed altitudes rather than maximum range.

Descent And Terminal Area

The destination area still appears to present problems requiring more study from the standpoint of aircraft/engine design, flight operating procedures, and the air traffic control system. The critical items here are the holding speeds, descent rates and forward speed during descent, and fuel consumption curves. The high holding speeds being considered by some manufacturers would require wider turning radius than the current standard needlewidth turn, even at altitudes of 10,000 to 15,000 feet. In the larger metropolitan areas, the airspace requirements for current holding patterns fairly well saturate the available airspace. Aircraft which would be operated at speeds much in excess of 180 m.p.h. in holding patterns below 15,000 feet would reduce the airspace capacity of a terminal area.

Industry thinking concerning "normal" descent rates for turbine-powered aircraft appears to differ somewhat among the various groups. It is planned that at 40,000 to 45,000 feet, the cabin will be pressurized at the 8,000-foot level. The normal rate of cabin depressurization is about 400 f.p.m., requiring some 20 minutes to equalize the cabin pressure to sea level. Therefore, some designers are not thinking in terms of other than a normal descent rate in excess of 2,000 to 2,500 f.p.m. The desired maximum cabin floor declination and the Vne (maximum allowable) speed appear to be factors influencing this thinking. However, the requirement for rapid emergency descent at a rate in excess of 10,000 f.p.m. (in case of inadvertent cabin depressurization at cruising altitude), plus the realization that cabin pressure can be equalized to airport elevation during descent from cruising altitude to 20,000, are militating toward designs incorporating a greater flexibility in "normal descent rate." One manufacturer feels that it is practical through adequate speed brakes and spoilers to have a normal descent rate anywhere between 500 and 10,000 f.p.m., with approximately 5,000 f.p.m. being most frequently employed.

Varied Emphasis

Likewise, as concerns forward speed during descent, there are some variations in current thinking. Too much emphasis appears to be placed upon the effect on "block time" in setting a high normal airspeed for descents. Not enough thought seems to be given to the fact that some descents may be made over or near terminals, or within holding patterns, and the aircraft will not be "going any place."

Therefore, it appears that more flexibility will be of great advantage in these phases of airframe/engine design. The ideal aircraft would be capable of holding at indicated airspeeds of 180 m.p.h. or less at altitudes below 15,000, and "normal" descent rates of 5,000 f.p.m. or more at a similar low airspeed.

The rates of horizontal and vertical speeds are items of somewhat lesser importance, however, in discussion of turboprop and turbojet jet aircraft, as compared to critical fuel consumption rates holding at lower altitudes and reserve fuel requirements. Examination of expected fuel consumption

The ALPA Camera

PAA-PNG Trackage

Interchange and Trackage Committee, meeting at Home Office, resolve 8-year "through-flight" trackage dispute between PAA and Panagra pilots. L. to r. (sitting): F. T. Sterling, W. L. Martin, Panagra; M. J. Fenello, EAL, chairman; G. LeRoux, A. J. O'Donnell, PAA; (standing): L. Treece, UAL; E. A. Feazel, TWA; C. C. Spencer, PAA-MEC Chairman, a visitor; J. G. Fickling, PAI; R. E. Dooley, AA.

Pension Plans

Ozark Captains Pontius, Fitch, O'Brien meet with ALPA's L. Koch, (second from left), for familiarization of retirement program.

EAL Council Meet

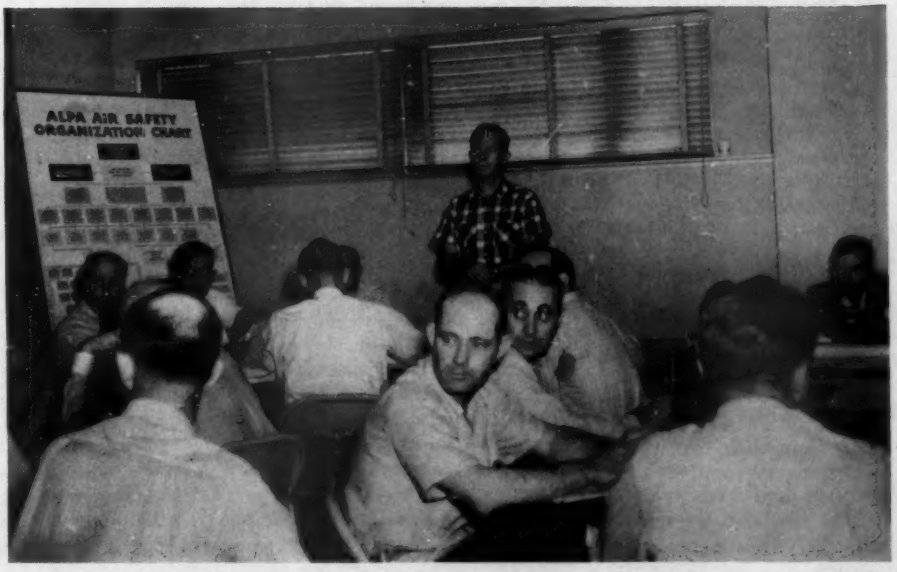
Chicago-based Eastern Air Lines Council in meeting at Home Office.

Turbo-Prop Propeller

Engineers of Aero Products Operations, Allison Division of General Motors Corp., acquaint ALPA group with new turbo-prop propeller, featuring forged hollow steel blade.

Physical Standards

ALPA Physical Standards Committee interviewing Dr. H. Fenwick, Chicago CAA Medical Examiner (sitting right), on pilots' physical standards problems. Others, l. to r.: W. W. Anderson, President's Assistant; W. A. Murphey, C. C. Transou, C. Eklund; (sitting): H. W. Orlady, chairman.



AA-MEC

American Airlines' MEC meets at Home Office.

curves shows that the "many-fold increase" so often referred to, with regard to turbojet aircraft, may be somewhat overemphasized. The fuel savings in holding at 20,000 feet, instead of 5,000, are in the order of 10 to 15 per cent. It is possible, however, that these rates would increase somewhat where the use of flaps or spoilers increases the power settings required to obtain lower airspeeds.

Fuel Reserves

Fuel reserves have been the subject of lengthy discussions between the designers and the aircraft operators. A number of different means of expressing fuel reserves have been mentioned —such as, "45-minute hold at destination at various altitude levels, followed by approach to landing, plus climb and cruise to a 300 mile distant alternate airport, an approach and landing plus a 45 minute holding reserve," or as one airline put it, "upon completion of the planned flight on the runway at destination, additional reserve fuel should equal two hours' flight, at 5,000 MSL, at 1.3 Vmd (minimum drag speed)." These appear to be the equivalent of 1,300 to 1,500 gallons for the turboprop and 2,500 to 2,600 gallons for the turbojet and, according to both designers and operators, well within the capabilities of the design. From the air traffic control standpoint, these figures merely indicate that the pilot of a turbine-powered aircraft will have somewhat less fuel limitations than heretofore expected, and can plan his IFR flight in a manner compatible with current "conventional" flight operation.

This compatibility is based on normal four-engine operation at all times. It has been pointed out that savings of approximately one-fourth in fuel consumption are possible with intentional two-engine operation during descent and holding. Some manufacturers emphasize that air-starts can be more sure and simpler than ground-starts, for example, 12-15 seconds per engine. Discussions with operators, however, indicate that good operating practice, at least in the beginning, will not include intentional engine shutdown in flight except in case of emergency.

Approach And Landing

Turbine-powered aircraft can be expected to be handled in a completely "normal" manner during an instrument approach, as well as in VFR weather. At approach speeds, these aircraft should be capable of the same flight patterns, pattern speeds, approaches, glide angles and turns as any so-called conventional transport aircraft. In fact, maneuverability will most likely be better, with spoilers and speed brakes, simplified power plant controls, and greater power ratio reserves. It is claimed that the type of control surface arrangement and actuation planned, will ensure maneuverability at low speed and altitude through increased lateral control with far less control pressure. On "wave-offs" or missed approaches, no special treatment appears necessary. The turbojet engines planned will be of the twin-spool type, permitting comparable or better acceleration than with piston-driven engines.

Landing runway length requirements, for similar range operations, are planned to be consistent with transport aircraft in operation today. The multiple-tire landing gear of the large turbojet, nonskid braking, greater percentage of weight on the gear immediately after landing, should all contribute to relatively rapid deceleration after landing. In addition, turbojet aircraft being discussed include provision for reverse thrust to be comparable in efficiency with propeller-driven aircraft. It appears that the turboprop "flat-pitch" propeller angle in idle speed will create sufficient drag for normal deceleration distances.

Our earlier worries about ground maneuverability, especially with respect to the use of high speed turn-offs after landing, appear to be somewhat unfounded insofar as civil transport planning is concerned. Current plans contemplate conventional type tricycle gear configuration, or equivalent tread width and strength to permit normal operation in both the turbojet and turboprop.

General Compatibility

Typical of the general industry attitude is the statement made representing the policy of one of the major air carriers to the effect that it does not plan to request or expect any special treatment, handling or procedures, nor any priority arrangements for any turbine-powered transport it will operate and, further, not only does it expect a similar attitude on the part of its competitors but it is unwilling to agree to the establishment of special procedures for any other operator of turbine-powered aircraft. It appears possible, therefore, that turbine-powered aircraft can and will be built, which will be capable of complete compatibility with other traffic and, further, that the general thinking of the air carrier companies will require that they be fully compatible.

Air Traffic Control Aspects

Throughout our discussions with both design engineering and airline representatives, there was the realization that the shortcomings of the present air traffic control system, with its attendant delays, would more drastically affect the economies of turbine-powered transports. Although even the turbojet apparently can be made to comply with current operating practices in every respect, such compatibility is achieved only through seriously penalizing the capabilities of these aircraft. The only "special" procedure which can benefit turbine-powered aircraft will be improvement of the basic air traffic control system, and will benefit such aircraft in direct ratio to their higher rates of fuel consumption.

The most critical areas in the air traffic control system, as it affects turbine-powered aircraft, are generally those causing annoyance and delay to today's traffic. Departure delays are a good example. Here we have some delays even in good weather at many busy airports, due primarily to a lack of adequate dual runways, or at least a usable diverging runway which can be used relatively independently of that used for landing traffic. In a few instances, heavily loaded large transport aircraft are limited for landing and take-off to the one long runway on an airport even where dual runways are available. In many cases, the pre-take-off cockpit check and engine run-up of conventional aircraft will delay turbine-powered aircraft where there is a lack of adequate warmup areas permitting large aircraft to bypass one another.

Radar Aid

In instrument weather, lengthy ground delays occasionally of as much as 45 minutes' duration are quite a handicap to all aircraft. Airport Surveillance Radar has been or is being installed at over 40 major airports at this time. Radar Departure Control procedures already have been inaugurated at nine of these locations in an effort to speed departures, and many more will be added in the next year.

Arrival delays have also been considerably reduced through use of this same radar equipment. In addition, long-range Air Route Surveillance Radar has been installed and in use for some time at Washington, was recently commissioned in the New York area and is planned for the Chicago area in the near future. Further locations are planned for later installation as funds and equipment become available. Our greatest hope for a quick expansion of this program is through

tie-in to the Air Defense radar system, which has been under study for some time. This is not as simple as it may seem on the surface, due to a number of technical reasons, and a need to ensure against the possibility of derogation of the air defense radar requirements, where conflict of needs may arise.

The longer range radar coverage will enable us to start reducing the en route traffic spacing at a greater distance from the terminal and permit a more steady flow of regularly spaced aircraft into the terminal area. It will also tie into the terminal Radar Departure Control, enabling the use of reduced radar spacing for getting departing aircraft well along toward their cruising altitudes. Progress is also being made on the development of a practical airborne transponder (Air Traffic Control Radar Beacon) to facilitate identification of radar targets and ensure continuous radar tracking. This beacon will be of greater importance to the efficient handling of turbine-powered aircraft since it will permit tracking while the aircraft is above the normal primary radar antenna pattern and can eliminate or reduce time- and space-consuming identification maneuvers.

Rho-Theta Navigation

Regardless of the outcome of the current VOR/DME vs. TACAN discussions, it is certain that some form of Rho-Theta navigation will be generally available as we enter the period of large-scale use of turbine-powered transports in civil air transportation.

The known advantages of such a navigation system to all aircraft will be of even greater value to turbine-powered aircraft. The constant knowledge of the aircraft's position in space, as contrasted with today's knowledge of relatively precise course information with only periodic indication of progress along the course, gives rise to almost limitless flexibility in navigation both en route and during instrument approach.

The availability of both bearing and distance from a single reference point makes possible, for example, the immediate selection of additional holding points in a terminal area as necessary, extremely precise ground speed data, flexibility of direction of low approaches to airports, which are equipped with Rho-Theta type navigation aid and pilot ability to monitor course and position accurately during radar vectoring. In addition, the turbine-powered aircraft will be particularly benefitted through ability to determine accurately actual wind speed and direction at cruising altitude, easily check progress and course adherence on direct route operation, and precisely select the point at which to begin letdown from cruising altitude.

BRANIFF AIRWAYS pilots paint house belonging to Capt. Allen R. Tobin, in Dallas, the pilot killed in July 17 crash at Chicago's Midway Airport. Mrs. Tobin, flyer's widow, stirs paint while son Jerry, 15, mows lawn.

Altimeter Problems

In the field of en route operation, progress is also being made, at least to the extent of studying possible problems peculiar to turbine-powered aircraft. Special Committee No. 70 of the Radio Technical Commission for Aeronautics has begun an intensive study of altimeter instrument errors, static system effects on altimeter accuracy, and improved altimetry systems. This study can be expected to examine the need for our present requirement of doubling the vertical separation requirements above 30,000 feet, and to make recommendations toward a more economical use of airspace at high altitudes.

Studies have been completed recently by another RTCA Special Committee, No. 57, which included proposed VHF frequency allocations to permit the use of certain VOR/DME facilities for long-range, high-altitude operation.

In the field of L/MF radio facilities and the use of ADF by high-altitude, high-speed aircraft, previously noted difficulties which have been encountered in military turbojet tactical aircraft are being carefully studied by several groups. At least two of the aircraft manufacturers have large electronic research departments which have devoted much time to this subject, as have several universities and electronic equipment manufacturers. The two most serious problems encountered appear to be capable of solution. The apparent bending or displacement of L/MF range signals seems to be a function of aircraft antenna design and location. Likewise, much of the problem with ADF usage, particularly the difficulties with precipitation and ice-particle static encountered at high altitude, appears to be soluble through proper design and location of the aircraft antenna. At least one manufacturer has gone so far as to alter the normal progress of basic aircraft design to the extent of designing the aircraft itself around properly designed electronic antennas.

High Altitude Control

Intensive study is being given to the control of all airspace at high altitudes to facilitate direct route operation. This project has not yet reached the stage where any definite statements as to practicality or methods may be made. The current high volume of military jet operation, coupled with the impending growth of civil transport operation at these high altitudes, has placed these studies at the top of our priority list.

Conclusions

To sum up, therefore, it appears that the fears and apprehensions at the

(Continued on Page 15)

Big Gamble, Long Odds

No Court Has Yet Set Aside An Arbitration Decision In A Merger

By F. Harold Bennett
Head, ALPA Legal Department

In the past several years, due to the considerable number of airline mergers, consolidations, and acquisitions, the Air Line Pilots Association has had occasion to devote considerable time, energy and substance to the problem of merging the Seniority Lists of the involved pilots.

It is a fair statement to make, that in the instance of each such merger, numerous pilots have been unhappy with the resulting List. Some would say, "unhappy" is a gross understatement.

No Constructive Approach

It is true, that there have been mergers, where pilots have been dissatisfied in sufficient number, to make their dissatisfaction known in no uncertain terms. Affirmative efforts of these dissatisfied groups, to correct supposed deficiencies in the new List, have usually taken the form of a suit in a State or Federal Court. No such suits have approached the problem constructively, since they do not suggest, or ask, a reformation of the List; they only seek to declare it null and void.

There have been eight such suits filed by dissatisfied pilots in the last several years; *none* have been tried, and *no* List has ever been changed or upset by these legal processes. Such litigation is necessarily very expensive for the pilots, their Association and their Company, and it is the intent of this article to demonstrate the utter futility of the pilots spending their money on these hopeless legal processes.

Futility Of Legal Process

The merged Seniority List is usually born of an arbitration, which is had pursuant to an arbitration agreement between the pilot groups. Such arbitration agreement not only provides that the resulting List will be final and binding upon the parties, but also includes a mandate to the Association that the new List be negotiated into an Employment Agreement with the merged Company. While the Law does not preclude a judicial review of an Award in Arbitration, such review is usually so narrow as to prohibit a successful legal challenge. That is to say. to successfully prosecute the judicial review of an Award, it is usually necessary to demonstrate by competent evidence that such Award came about as the result of a fraud. or that the Award carried beyond the issues defined in the Arbitration Agreement, or that one party to the Arbitration Agreement was not afforded an opportunity to be heard.

Another Obstacle

If these were not obstacles sufficient to deter the filing of such suits, still another and greater difficulty usually confronts this litigant. By the time the dissatisfied employees have gotten themselves squared away to file their suit, the Association, as mandated by pilots in the Arbitration Agreement, has already negotiated the new List into an Employment Agreement. The List has now lost its identity as an Arbitration Award and has become part and parcel of an Employment Contract. Any Court Decree, to be effective, must now not only void the Award, it must nullify the Employment Agreement as well. To accomplish this, the Court must invade the right and duty of a Collective Representative under the Railway Labor Act to make and maintain Employment Agreements. Complication and legal hurdles, which the dissatisfied group must overcome, loom so large that their legal counsel finally decides his position is hopeless and the suit is abandoned.

Chaos Seen

Most often this type of litigation is disposed on preliminary pleadings and motions, and there is never any real threat to the new List. We cannot help but speculate however, upon the chaotic situation which would ensue if, by some stretch of the imagination, a dissatisfied group would be so unfortunate as to one day be successful.

As previously stated, such suits never ask that the new List be reformed, or suggest the terms of such reformation; it is requested only that the List be declared void. If the Arbitration Award, and the List now negotiated into the Employment Agreement with the newly merged Company, are both voided, Seniority would be "up for grabs" until a new List could be negotiated. Experience has taught us that a new List would require the same process, which brought the voided List into being.

No Complete Satisfaction

Having suffered through a period during which the Company would of necessity dictate Seniority, let us assume that still another List is arrived at, and that each of the former dissatisfied pilots are now happily ensconced in an enhanced seniority position. How many pilots would now be unhappy and dissatisfied with his placement on the reformed List? The answer is obvious: Every pilot whose position had been worsened. The number could not be less than the previous number of unhappy pilots, and in all probability it would be more. Additionally, the unhappiness and dissatisfaction with the reformed List would be with more reason, because these dissatisfied employees were once better placed on a previously "merged List" with the new Company. Why not then repeat the process? The pilots being once successful in such litigation, your Association sees no end to the strife which would ensue.

A Sensible Approach

Frankly, so long as there is no agreement among the pilots on the reformation of a new List, there is little likelihood, if any, that changes can be accomplished. If any reform is to be made in the List, it can be brought about only by the processes provided within the framework of the Association; that is to say, the pilots must *agree,* through their Association, upon the changes to be made in the List, or they must *agree* that changes are appropriate and the method to be employed in bringing about these changes. No other procedure has more than the remotest chance of success, least of all a "legal procedure".

Wanted: More, Better Airports

More Than Ever, An Adequate Airport System Is A Must For The Betterment Of The National Economy — And Security

Reprinted from PLANES

No forward thinking person in this modern day and age can possibly doubt that air transportation is having an ever-increasing and beneficial effect on the nation's economy. Shrinking distances, which just a few short years ago were measured in days and weeks, are now measured in minutes and hours. The use of the air for transportation by the airlines of the nation and individually by businessmen, and for the needs of industry and agriculture, is growing at an incredible rate.

Now a new and ambitious Federal airport construction program, which will make $58 million dollars of federal monies available in each of the next four years, to help the nation catch up on its airport building program, has become law after being passed by Congress and signed by the President.

1946 Program Failed

In 1946, the Federal government undertook a program of federal aid based on a National Airport Plan. Under this Federal Airport Act, the government, in seven years was to spend one-half billion dollars, matched by similar amounts of federal, state and local money in airport construction. It would have resulted in an adequate system of airports. Unfortunately, it was never fully implemented.

The results of making major population centers, such as are served by the airlines, accessible are readily apparent in the growth which has occurred in our airline industry, with incalculable benefits to the national economy and new horizons for the air traveling public.

However, though federal, state and local governments have invested many millions of dollars in major airport facilities, there has been little heed given to the need for a network of small airports. Adequate attention should also be paid to a national system of smaller airports designed to make every American community readily accessible by air.

Growth Of Airlines

In just the past ten years the airlines of the nation have grown more than five times in size. This year they will carry nearly 50 million passengers. The personal use of aircraft in general aviation has also evidenced a remarkable growth, accounting for almost 9 million hours of flying in 1954. Privately owned civil aircraft are flying two and one-half times more than do the airlines of the nation. The use of privately owned aircraft for business—an important segment of general aviation—soared to 3,900,000 hours in 1954. This means that American businessmen, in their own planes, flew 800,000 more hours than the airlines—a 50 per cent rise in volume from two and one-half million hours in 1949 to almost four million hours during the past year. All evidence documents the fact that these growth trends of civil aviation, both transport and general, are vigorious and will continue.

The United States aircraft industry has made enormous improvements in safety, speed and comfort of modern transport aircraft, which undoubtedly has a bearing on the rapid growth of transport aviation. And certainly, the fact that the cities served by the airlines had airports of a size to make them accessible also had significant bearing on these developments. This initial accessibility demonstrated the value of airline service, but ten years ago when the airlines began this rapid growth, less than 300 cities were offered scheduled airline service. Today, despite this enormous growth of the air transportation industry, less than 600 cities receive regular airline service.

Need For Adequate System

There are today about 6,000 airports of various size in the United States, but there are several times this number of incorporated urban areas and

On The Cover

A program to install some $2,000,000 worth of RCA C-Band Airborne Radar in Pan American World Airways' Clippers gets underway at the airline's Miami Overhaul Base as the first set is installed in a Super-6 Clipper. A Radar Technician is shown making the final adjustments to the first installation.

Work of installing the sets on PAA's fleet of 48 Super-6 and seven Super-7B Clippers will be completed in Miami by the spring of 1956.

Sets in 33 Super "Seven Seas" Clippers being delivered in 1956 are being installed in the factory.

vast rural areas which are still not on the air map.

More than ever, an adequate system of airports is a must to the betterment of the national economy—*and* security. The Federal government, which historically has aided new forms of transportation, has a substantial stake and responsibility in bringing about a national system of airports, which is adequate for the further development of aviation for transport, for business, industry and agriculture.

Suitable airports are essential to modern living. Moreover, in this age of peril, and with full knowledge of the potential devastation, which could be wreaked upon cities and urban communities, an adequate system of airports is vital to the civil defense—a key to survival.

"Collision-itis" . . .

(Continued from Page 3)

collision right on schedule some day. The "realistic schedule" facet shines pretty dim in this light.

With today's closure rates and the smoke-infested visibilities around the large metropolitan areas we fly into, *the pilot just cannot see that head-on aircraft soon enough to avert a collision anymore!*

What, then, is the answer to the mid-air collision problem?

100% Control

Captain Arthur Jenks, Chief, Flight Inspection Division, CAA, in his letter recently printed in the Flight Safety Foundation's Pilots' Safety Exchange Bulletin 55-106, July 8, 1955, wrote: "100% Control is Goal. . . . I believe that one of the reasons why we do not have more collisions, is the fact that there is still a lot of room and our separation standards are still pretty high. With more and more aircraft being put into service, we are nearing a saturation point, particularly in terminal areas, and I firmly believe that the IFR control of all traffic is a must if we are going to improve safety."

It's as simple as that! 100% IFR control in the congested areas! (Any two airplanes close to another is a "congested area.")

One major air line dispatches every trip IFR right now. Most pilots file IFR and fly controlled regardless of the weather on the majority of their trips. These are steps in the right direction, but protection from mid-air collision is nil until we do have 100% IFR traffic in the congested areas.

How soon can we have 100% control in the high density areas?

Facilities Exist

We have all the facilities we need to switch to 100% IFR control right now. Victor airways are cobwebbing the country and your ARTC traffic controllers are sitting at their control boards 24 hours a day, seven days a week, ready to serve you, regardless of the weather. All we need now is for the aviation industry to have the *will*

A Correction

We regret that in the article "Designing for Accident Survival" by A. Howard Hasbrook, which appeared in the September issue of THE AIR LINE PILOT, *we neglected to mention, that Aviation Crash Injury Research is supported by the U. S. Departments of the Navy and Air Force, through a contract between the Office of Naval Research and Cornell University.*

We also should have pointed out, that reproduction of the article, in whole or in part, is permitted for any purpose of the United States government.

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to change to 100% control before it is forced on us by the public's reaction to continued mid-air collision incidents.

Since ARTC manpower requirements are based in part on the average number of IFR trips, they are doing business with each day, every trip that goes out VFR into "the wild blue" drags the Centers' daily average down. Then on that day "the wild blue" is infested with clouds all the way up and we are all screaming for our clearance, these unsung gentlemen are sorely overworked. The New York Center alone, in one single 24-hour period ending last June 9, posted on their flight strips, *10,761 individual position reports!* If 100% control started today, there undoubtedly would develop the very same traffic "bottlenecks" we encounter on the IFR days because of the part-time use we now make of our ARTC service. It is quite reasonable to assume, however, that these traffic bottlenecks would soon be solved under the daily use and experience of 100% control. Human nature being what it is, we tolerate the part-time problem a lot longer than we would the constant one.

Effort And Cooperation Needed

This mid-air collision problem will only be solved through the will to do so and the cooperative effort of the entire aviation industry, but it can be solved with the facilities we have at our disposal right now.

The aviation industry is still too young and tender a baby not to be scarred by the blow it would receive from the public's reaction to a needless mid-air collision of two major air carriers in the sky over one of our heavily populated metropolitan areas.

The screaming headlines would no doubt be: PILOT ERROR!

Turbo Power . . .

(Continued from Page 11)

thought of widespread turbine-powered aircraft use in civil transportation—with the attendant "insurmountable operating problems"— can be virtually completely forgotten provided that these ideas are proven to be practical and airworthy. In return, we who are responsible for the development and operation of the Federal Airways system find ourselves under a rather strong obligation to redouble our efforts to improve that system to minimize delays and other impediments to the safe, efficient and economic use of the system by all types of aircraft. We further realize fully that, regardless of our recognition of this obligation, the operators of turbine-powered aircraft will not let us rest short of virtual perfection.

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